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RESEARCH

ARE THE BENEFITS OF PULMONARY REHABILITATION IN YOUNG AND ELDERLY PATIENTS THE SAME?

Abstract

Introduction: Pulmonary rehabilitation is an interdisciplinary and comprehensive program for patients with decreased daily life activity and symptomatic in addition to medical therapy. The study was aimed to investigate the difference between pulmonary rehabilitation achievements in young and elderly patients with chronic pulmonary diseases.

Materials and Method: Patients with chronic respiratory diseases who completed 8-week PR programme evaluated in a retrospective cohort study. Patients demographics, exercise capacity, quality of life score were obtained prior and after pulmonary rehabilitation were evaluated. Patients were evaluated in 2 groups; young (age <65 years) and elderly (age≥65 years) patients.

Results: A total of 73 patients, 58 men with mean age 61±10 was evaluated. There were 55 Chronic obstructive pulmonary disease, 8 bronchiectasis, 5 interstitial lung disease, 5 kyphoscoliosis. There were 42 patients in younger patient group and 31patients in elderly group. The distribution of chronic obstructive pulmonary disease and other chronic respiratory diseases, comorbidities, gender, oxygen treatment, Modified Medical Research Council dyspnea score, St.George's Respiratory Questionnaire score among young and elderly patients were similar (p>0.05). In both age groups after pulmonary rehabilitation, significant improvement in exercise capacity (p=0.001) and St.George's Respiratory Questionnaire score (p<0.05) was obtained.

Conclusion: In the present study we showed that there was no difference in pulmonary rehabilitation achievements between patients with chronic respiratory diseases under 65 years and older. Pulmonary rehabilitation is beneficial in elderly patients as an addition to medical treatment like younger patients.

Key Words: Aged; Exercise therapy; Frail elderly; Pulmonary Disease, Chronic Obstructive; Quality of life; Rehabilitation

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ARAŞTIRMA

GENÇ VE YAŞLI HASTALARDA PULMONER REHABİLİTASYONUN KAZANIMLARI AYNI MIDIR?

Öz

Giriş: Pulmoner rehabilitasyon, günlük yaşam aktivitesinde azalma ve tıbbi tedaviye ek olarak semptomatik olan kronik solunum hastaları için interdisipliner, kapsamlı bir programdır. Bu çalışmada genç ve yaşlı kronik akciğer hastalarında pulmoner rehabilitasyon kazanımları arasında farkın araştırılması amaçlanmıştır.

Gereç ve Yöntem: Kronik akciğer hastalığı olan ve 8 haftalık pulmoner rehabilitasyon programını tamamlayan hastalar retrospektif kohort çalışması ile değerlendirildi. Hastaların rehabilitasyon öncesi ve sonrası kaydedilen demografik özellikleri, egzersiz kapasiteleri ve yaşam kaliteleri değerlendirildi. Hastalar genç (65 yaş altı) ve yaşlılar (65 yaş ve üzeri)olmak üzere 2 grupta incelendi.

Bulgular: Yaş ortalaması 61±10 olan 58 erkek, toplam 73 hasta değerlendirildi. 55 Kronik obstrüktif akciğer hastalığı 8 bronşektazi, 5 interstisyel akciğer hastalığı, 5 kifoskolyoz hastası mevcuttu. Genç hasta grubunda 42, yaşlı hasta grubunda 31 hasta mevcuttu. Genç ve yaşlı hastalarda kronik obstrüktif akciğer hastalığı ve diğer kronik akciğer hastalıkları, eşlik eden hastalıklar, cinsiyetleri, oksijen kullanımı, St. George Solunum Anketi ve Modified Medical Research Council skor dağılımı benzerdi (p>0,05). Her iki yaş grubunda pulmoner rehabilitasyon sonrası, egzersiz kapasitesinde anlamlı artış (p=0.001) ve St. George Solunum Anketi skorunda anlamlı düzelme saptandı(p<0.05).

Sonuç: Kronik akciğer hastalığı olan 65 yaş altı ve 65 yaş üstü hastalar arasında,egzersiz kapasitesinde ve yaşam kalitesindeki pulmoner rehabilitasyonun sağladığı kazanımlarda herhangi bir fark olmadığı saptanmıştır. Pulmoner rehabilitasyon yaşlı hastalarda kronik akciğer hastalığı olan genç hastalar gibi tıbbi tedaviye ek olarak yararlıdır.

Anahtar Sözcükler: Yaşlı; Egzersiz tedavisi; Kırılgan yaşlılık; Akciğer hastalığı, Kronik Obstrüktif; Yaşam kalitesi; Rehabilitasyon

INTRODUCTION

Chronic respiratory diseases have led to increase in problems including mortality, morbidity and rising costs worldwide. In this context, the development of new approaches for non-pharmacologic treatments, such as pulmonary rehabilitation (PR), is essential. PR is a comprehensive and interdisciplinary programme for patients with decreased daily life activity and who are currently undergoing symptomatic and medical therapy. The primary goal was to reach a patient's optimal functional level and quality of life. PR programmes are evidence-based and designed according to the needs of each patient (1,2). PR is highly recommended for patients with chronic pulmonary disease.

There is no age limit in the selection of candidate patients for PR. The definition of old age is commonly accepted as 65 years. However, this definition varies across countries (3). Previous studies have compared the outcomes of PR among younger and elderly patients with chronic obstructive pulmonary diseases (COPD). Moreover, PR is also recommended for other chronic pulmonary diseases (4,5).

In this study, we aimed to evaluate the effectiveness of PR among young (age <65 years) and elderly (age ≥65 years) patients with chronic pulmonary diseases. Specifically, we aimed to answer the research question, "Are there any differences in exercise capacity and the impact on quality of life among young and elderly (age 65 years and older) patients involved in a PR programme for the treatment of chronic pulmonary disease?"

MATERIALS AND METHOD

The study was designed as a retrospective cohort study between May 2014 and December 2015 in the PR unit of a tertiary training hospital for chest diseases. It was approved by the Ethics Committee of the Sureyyapaşa Chest Disease and Thoracic Surgery Training Hospital. Ethical approval was in accordance with the Declaration of Helsinki. Written informed consent was obtained from the patients.

Patients

Patients with chronic respiratory diseases were enrolled in the PR programme in day-hospital setting. Meanwhile, patients with cognitive disorders, unstable cardiac, neurologic or orthopaedic diseases were not included in the PR.

Patients diagnosed as having COPD according to the Global Initiative Chronic Obstructive Pulmonary Disease (GOLD) and had not experienced worsening of respiratory symptoms and hospital admissions for at least 4 weeks prior to PR. Other recruitment criteria included age over 40 years, a forced expiratory volume (FEV 1) of <80% of the predicted value and a ratio of FEV 1 to forced vital capacity of ≤0.7 (6).

Patients with diseases other than COPD; bronchiectasis, interstitial lung disease (no patients received systemic corticosteroids), and kyphoscoliosis patients were referred to PR.

All patients underwent cardiological assessment prior to PR. Patients who completed the 8-week PR programme with chronic respiratory diseases were included in the study. Patients were excluded if they were candidates for surgery and had undergone a preoperative short-term PR or if they cannot perform walking test because they could only exercise in bed.

Measurements

The spirometry was performed using ZAN 300 pre- and post-PR. Body mass index (BMI) and fat-free mass index (FFMI) were calculated with bioelectrical impedance (Tanita Body Composition Analyser, Model TBF-300).

Measurement of Exercise Tolerance: Each patient's exercise capacity was evaluated using the Incremental Shuttle Walk Test (ISWT). Otherwise, if the exercise capacity was low and the burden of the disease was high, they were evaluated using the Six-Minute Walk Test (6MWT).

Incremental Shuttle Walk Test was used to measure the sub-maximal exercise capacity of each patient. ISWT was performed in accordance with the guidelines set by the European Respiratory Society/ American Thoracic Society (7). The modified Borg dyspnoea score and blood pressure was recorded before and after walking. The patients were instructed to walk between two cones with signals in time to a set of auditory beeps on a CD. The distance between the two cones was set at 10 m, and the walking speed was increased at 1-minute intervals. The test was ended if the patient felt too breathless to continue or when the patient failed to complete 10 m within the allowed time. Heart rate and oxygen saturation were monitored during the test (8).

6MWT was performed according to the guidelines set by the American Thoracic Society (9). The participants were instructed to walk back and forth in a 30 m corridor. The modified Borg dyspnoea score and blood pressure were recorded before and after walking. The walking distance at the end of 6 min was recorded. The test was repeated, and the best results were evaluated (10).

Questionnaires: Dyspnoea was assessed by the Modified Medical Research Council (mMRC). The St.George's Respiratory Questionnaire (SGRQ) was used for the assessment of health-related quality of life. The scores range from 0 (no impairment) to 100 (maximum impairment). The subcategory scores (symptoms, activity and impact) and total score were calculated (11,12). The Hospital Anxiety and Depression Questionnaire (HADS) was used to assess anxiety and depression. The questionnaire has 14 items, a person can score between 0 and 21 for either anxiety or depression (13). COPD Assessment Test (CAT)was applied to COPD patients (14).

PR programme: An 8-week (2 days/week) outpatient PR programme was delivered by three physiotherapists. Exercise programmes were tailored to each patient's initial exercise capacity. The intensity of the workload was 60–85 % of the maximal workload based on the results of the 6MWT and ISWT. Each session included cycle ergometer and treadmill training for 30 min, upper and lower limb strengthening and breathing exercises. The workload intensity was increased according to each patient's improvement. Bronchial clearance techniques and energy conservation methods were also added to the programme depending on the patients' complaints (15).

Patients receiving long-term oxygen therapy (LTOT) also received O2 during the PR sessions, other patients received O2 if SpO2 fell below 90%.

A written home exercise programme were given to all patients, who were encouraged to exercise at home apart from the designated session days. Patients' medical therapies were optimised, and the patients and their relatives were informed by educational sessions for inhaler medication techniques and diseases. Psychological and nutritional support were also provided for the patients as needed.

Data collection

Patients demographics, clinical and anthropometric data, spirometry, exercise capacity, QoL were obtained prior and after PR programme. Patients were evaluated in two groups; young (age <65) and older (age ≥65) patient groups.

Outcomes

The primary outcome was exercise tolerance, and the secondary outcome was QoL.

Statistical Analysis

The Mann–Whitney U-test and Student's t-test were used for analysing the continuous variables with non-parametric and parametric values, respectively. The chi-square test was applied for categorical variables (gender, co-morbidity) of both age groups. A p-value < 0.05 was accepted as statistically significant. Changes within the groups were analysed with the Wilcoxon test. The median with inter-quartile range was employed for non-parametric continuous variables, and mean ± standard deviation was used for parametric continuous variables. Count and percentage were used when applicable.

Table1. The demographic characteristics of PR patient (n=73).

Characteristics	
Age (mean±sd)	61±10
Gender, n (%)	
Female	15 (20.0)
Male	58 (80.0)
Chronic pulmonary disease, n (%)	
COPD	55 (75.0)
Non-COPD	18 (25.0)
Interstitial lung disease	5 (7.0)
Kyphoscoliosis	5 (7.0)
Bronchiectasis	8 (11.0)
Smoking (packyear) median (IQR)	36 (10-57)
Comorbidities, n (%)	
Hypertension	19 (26.0)
Congestive heart failure/Chronic ischemic heart disease	11 (15.0)
Diabetes Mellitus (DM)	6(8.0)
LTOT, n (%)	23 (32.0)
NIV, n (%)	10 (14.0)
BMI (kg/m^2)*	26±5.8
FFMI (kg/m^2)	18.8± 4
mMRC	2±2
FEV$_1$ %	43±18

* mean±sd

RESULTS

A total of 73 patients, 58 (80) men and 15 (20) women, with mean age 61±10 were evaluated. There were 55 (75%) COPD patients and 18 non-COPD patients (8 bronchiectasis, 5 interstitial lung disease and 5 kyphoscoliosis). The most common co-morbidities were hypertension 26%, congestive heart failure/ chronic ischaemic heart disease 15% and diabetes mellitus (DM) 8%. Among the patients, 23 (32%) were receiving LTOT and 10 (10%) were using non-invasive ventilation (NIV) at home. Table 1 shows the patients' demographics.

There were 42 (58%) patients in the younger patient group and 31 (42%) patients in the elderly group. The distribution of the COPD and non-COPD patients' co-morbidities, gender, BMI, LTOT, MMRC, SGRQ and HADS score among the young and elderly patients were similar (p>0.05). Table 2 shows the distribution of young and elderly patients.

Table 2. The distribution of patients as young and elderly completed PR.

Characteristics	Age <65 years N=42	Age ≥ 65 years N=31	p
Age, mean±sd	55±8	69±4	
Gender, n (%)			
Male	31 (72)	27(90)	0.06
Chronic pulmonary disease, n (%)			
COPD	30 (70)	25 (83)	0.18
Comorbidities, n (%)			
Hypertension	10(23,8)	9(29)	0.61
Congestive heart failure/Chronic ischemic heart disease	6(14)	5(16)	0.83
Diabetes Mellitus (DM)	3(7)	3(10)	0.69
BMI (kg/m^2), mean±sd	25±7	26±5	0.66
FFMI(kg/m^2), mean±sd	18.3±5	19.7±2	0.16
LTOT , n (%)	14(33)	9(29)	0.70
NIV, n(%)	9(21)	1(3)	**0.025**
CAT*	20±8	19±8	0.83
mMRC, mean±sd	2±1	2±1	0.38
SGRQ score, mean±sd			
Symptom	65±18	58±24	0.15
Activity	71±21	63±21	0.10
Impact	52±22	43±25	0.12
Total	60±18	52±22	0.08
HADS, mean ±sd			
Anxiety	9±5	6±4	0.06
Depresssion	8±5	9±4	0.64

* CAT was applied to COPD patients

Table 3 defines the changes in exercise capacity and QoL in young and elderly patients before and after PR. ISWT was performed in 62 patients. In both age groups, gains in exercise capacity measured by ISWT after PR was statistically significant (p=0.001). In 11 patients (7 young patients and 4 elderly patients) whose exercise capacity was low and the burden of the disease was high, the 6MWT test was performed. In younger patients, improvement in 6MWT after PR was significantly higher than that in the elderly group (p=0.028 vs. p=0.11), whereas in the elderly patients, minimal clinically important difference (MCID) (30m) was established. SGRQ revealed significantly higher improvement after PR in both age groups (p<0.05) .

Table 3. The changes of exercise capacity and quality of life in young and elderly patients before and after PR.

Characteristics	Age < 65 years N=42			Age ≥ 65 years N=31		
	Before PR	After PR	p	Before PR	After PR	p
ISWT(m),IQR*	320(220-430)	405(300-500)	0.001	330(260-400)	390(330-470)	**0.001**
6MWT(m),IQR**	200(160-280)	310(260-400)	0.028	224(159-338)	309(235-422)	0.11
CAT, mean ±sd ***	20±9	13±7	0.001	19±8	12±8	**0.003**
mMRC, mean ± sd	2.3±0.8	1.7±0.9	0.001	2±0.8	1.6±0.7	**0.001**
SGRQ , mean ± sd						
Symptom	64±19	56±17	0.008	58±24	48±21	**0.016**
Activity	72±21	60±21	0.001	63±22	51±24	**0.006**
Impact	52±23	37±23	0.001	43±27	32±22	**0.001**
Total	60±19	50±19	0.001	52±23	40±21	**0.001**
HADS, mean± sd						
Anxiety	9±5	7±4	0.014	7±4	5±4	0.07
Depression	8±5	7±4	0.26	8±4	6±4	**0.002**

* ISWT performed in 62 patients.**6MWT was performed in 11 patients,***CAT was performed in COPD patients

Table 4. The differences in walking capacity and quality of life measures of young and elderly patients before and after PR.

Characteristics	Age <65 years N=42	Age ≥ 65 years N=31	p
Δ ISWT* (m), median (IQR)	60(30-120)	80(50-110)	0.62
Δ 6MWT**(m), median (IQR)	65(30-190)	56(11-148)	0.57
Δ SGRQ total score, median (IQR)	-12.2(6-22)	-11(5-19)	0.51

*ISWT performed in 62 patients,**6MWT was performed in 11 patients, Δ:Representing the changes before and after PR

Table 4 summarises the rehabilitation responses of young and elderly patients. In younger patients, median 60 (30–120) m and 80 (50–110) m increase in the elderly group was recorded in ISWT after PR. In the SGRQ total score, a median 12.2 (6–22)-point decline in the younger group and 11 (5–19)-point decline in the elderly group were recorded. In terms of gains of ISWT, 6MWT and SGRQ ($p>0.05$), no significant difference was observed in both age groups.

DISCUSSION

In the present study, we demonstrated that there is no difference in the benefits of PR in the exercise capacity and the QoL between patients under 65 years and older with chronic respiratory diseases.

The incidence of chronic diseases increases with age. The number of drugs used due to illnesses increases and, in case of necessity, the use of additional medical devices is required. The world population is rapidly ageing and COPD is supposed to be the third leading cause of death worldwide by 2030 (16). The GOLD guidelines have accepted PR as a comprehensive non-pharmacological treatment aside from medical therapy (6). The age limit for being elderly is commonly accepted as 65 years, but this definition may also vary across countries depending on a wide range of socio-economic factors.

Mainly, in COPD and other chronic respiratory diseases, restriction in gas exchange, cardiac restriction, ventilatory limitation, as well as lower extremity and respiratory muscle dysfunctions result in shortness of breath and movement restrictions that are more prominent in elderly patients (1,17). O_2 and NIV support, when necessary, cause the patient to reduce their movement and stay at home more often. Past studies have shown that PR has positive effects on elderly COPD patients (18,19). In the current study, COPD patients as well as those with chronic pulmonary diseases other than COPD were involved. In our results, minimal clinically significant values were reached both in elderly COPD and non-COPD patients. These findings suggest that PR is appropriate not only for COPD but also for other chronic lung diseases. It is especially important that patients with early-stage interstitial lung disease are recommended to undergo PR (20).

The patients' frailty and respiratory impairment are important factors that trigger each other. Over time, patients become increasingly inactive and their loose muscle strength results in sarcopenia and frailty. Jones reported that 25.6% of the stable COPD patients are frail; however their frailty improved after PR (21,22). Considering this matter and taking the necessary precautions can indeed help patients with chronic lung disease in the future. In the present study, we did not evaluate the frailty of the elderly group and the improvement of their frail states after PR. However, considering frailty may be useful in future studies.

Another finding of the current study is that PR increases the exercise capacities of young and elderly patients. We performed the 6MWT in elderly patients who were unable to adapt to ISWT with reduced effort capacity. After 6MWT, the increase in exercise distance after PR was not statistically significant, although patients reached MCID values. An increase of 47.5 m in ISWT, 30 m in the 6MWT, a score of 4 in SGRQ, a 1.5 score in HADS and a score of 2 in CAT are all clinically important (12,23). Results indicated that such improvements can be achieved by both young and elderly patients.

In the present study, a significant statistical improvement in depression scores was observed after PR in patients over 65 years of age ($p=0.002$). However, there was no significant change in depression scores after PR in patients under 65 years ($p=0.26$). Meanwhile, there was a significant change in the anxiety score in younger patients ($p=0.014$) after PR. Both depression and anxiety cannot be fully realised by the patients. In the evaluation of this result, we think that the socio-cultural features can lead to differences in how patients express the constraint they are experiencing. Inability to perform personal affairs due to dyspnoea, social isolation, need for care and frequent hospital appointments often result in depression and anxiety.

This situation is also observed in the patients' caregivers over time. Depression is frequently reported in patients with chronic lung diseases (24,25). This group of patients should be observed in terms of depression and anxiety in the outpatient clinic, and the necessary patients should be

recommended to undergo psychological support. Significant improvements in the QoL assessments in both age groups indicate that they reach the goal of PR. Our goal in implementing PR is to ensure that patients are liberated as individuals and that they become more active.

In the PR programme, we also encouraged the patients to practice at home by following a written home exercise programme, which included exercise figures, apart from an 8-week (2days/week) outpatient PR programme. Educational sessions for inhaler medication techniques as well as O_2 usage for patients and their caregivers also positively affected compliance.

Aside from the exercise programme, undergoing PR also provides a social network for patients and a relief from social isolation; helps keep alliances with families and relatives; increases awareness about their disease, thus increasing the strength of the relationship between the patient and the physician; and increases their ability to control the disease and reduce the number of hospital appointments. Future studies may be able to demonstrate how gains achieved in PR among elderly patients can continue compared with those gained by younger patients.

The current study also has limitations. As this is a retrospective study, there may be some missing data. The study was carried out in a single centre, and limited generalisation of the data may be considered. Nevertheless, the strength of this study lies in its demonstration of the importance of PR in increasing disease awareness and in the fact that we also included chronic respiratory diseases other than COPD.

In conclusion, PR provides significant improvement for patients with chronic pulmonary diseases under 65 years and older and suffer from decreased exercise capacity and dyspnoea perception. PR in elderly patients, as an addition to medical treatment, is beneficial as it is for younger patients with chronic pulmonary diseases.

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